2.0 PROJECT DESCRIPTION

2.1 Introduction

The Henrietta Peaker Project (HPP) consists of a 91.4-net-megawatt (MW) (annual average conditions), natural-gas-fired, simple-cycle power plant, with a 70-kilovolt (kV) switchyard and approximately 550 feet of new 70-kV transmission line. The new transmission interconnection will be to the existing Pacific Gas and Electric Company (PG&E) Henrietta Substation to the north and contiguous with the project site. Natural gas for the facility will be delivered via approximately 2.2 miles of new 12-inch pipeline that will connect to the existing Southern California Gas Company Line 800 approximately one mile south of the intersection of 25th Avenue and the Avenal Cutoff. Kings County and the Westlands Water District will supply water to the HPP from an existing Westlands Water District line immediately adjacent to the HPP site on 25th Avenue. The site will utilize water treatment and recycling technology to achieve a near-zero discharge of wastewater from the HPP. A licensed hauler will dispose of the small quantity of wastewater generated by the plant at an approved offsite disposal facility.

The HPP site is located on the eastern side of 25th Avenue, approximately one mile south of State Route (SR) 198 and directly south of the PG&E Henrietta Substation. Figures 2-1a and 2-1b show the location of the proposed generating facility, electric transmission line, natural gas supply line, and water supply line. Additional information on ownership and location is provided in Section 8.4 (Land Use).

GWF Energy LLC (GWF) has acquired a 20-acre parcel south and adjacent to the PG&E Henrietta Substation. A copy of the Grant Deed for the parcel (a 20-acre portion of APN #024-190-065) is included in Appendix G. The plant will be developed on the northwestern portion of that parcel using approximately seven acres. The temporary construction laydown/parking area will require an additional 5 acres within the 20-acre parcel.

The following sections describe the design and operation of the power plant and the associated electric transmission line, natural gas supply line, and water supply line. The site selection process and the alternative sites considered are discussed in Section 5.0 (Alternatives).

2.2 Power Plant Description, Design, and Operation

This section describes the facility's conceptual design and proposed operation.

2.2.1 Site Plan and Access

The site layout drawing and site general arrangement are shown on Figure 2-3a and 2-3b, respectively. The typical elevation views shown on Figure 2-4a and 2-4b illustrate the location and size of the proposed power plant. The HPP will be visually compatible with the existing PG&E Henrietta Substation, which already introduces an industrial element into the surrounding area. The visual simulations with and without the proposed project are included in Section 8.11 (Visual Resources). The textual descriptions of the appearance and the architectural treatments to be employed in the HPP are also provided in Section 8.11.

The power plant area will be accessed via a plant entrance and exit on 25th Avenue (Figure 2-2).

2.2.2 Process Description

The power plant will consist of two General Electric (GE) LM6000 PC Sprint combustion turbine generators (CTGs) equipped with water injection and selective catalytic reduction (SCR) systems that use aqueous ammonia to control nitrogen oxides (NO_x) and an oxidation catalyst to control carbon monoxide (CO) and volatile organic compounds (VOCs). Air pollutant emissions from the HPP will be controlled to concentrations at or below Best Available Control Technology (BACT) levels for all criteria air pollutants.

Each CTG will generate an average of 46.9 MW (gross) output. The CTG exhaust gases will pass directly through the air pollution control systems before being discharged through an 85-foot-tall stack. Approximately 2.4 total MW will be consumed by the internal electrical demands of the plant, resulting in a net plant output of 91.4 MW. The project is expected to have a minimum overall annual capacity factor of approximately 50 percent, although during the first few years the HPP is expected to operate at significantly higher capacity factors. The HPP will be dispatched by the California Department of Water Resources (DWR) under an existing power purchase agreement. To enable the project to respond to California's electrical transmission/distribution system demands, GWF is seeking a license to operate the plant up to 8,000 hours per year.

Heat balances for power plant base load operation are presented on Figures 2-5, 2-6, and 2-7. The three cases are at 15, 63, and 115 degrees Fahrenheit (°F).

Associated equipment includes emission control systems necessary to meet the proposed emission limits. NO_x emissions will be controlled to 3.6 or less parts per million by volume, dry (ppmvd), corrected to 15 percent oxygen by a combination of water injection into the combustor of the CTG and SCR system. CO emissions from the CTG will be controlled with an oxidation catalyst to 6 or less ppmvd at 15 percent oxygen. VOCs will be controlled to 2 or less ppmvd at 15 percent oxygen using the same oxidation catalyst.

2.2.3 Power Plant Cycle

The HPP will be a simple-cycle peaker plant. CTG combustion air will flow through the inlet air filter and evaporative cooler and associated air inlet ductwork, be compressed, and then flow to the CTG combustion section. Natural gas fuel will be injected into the compressed air in the combustion section and ignited. Water is injected in the combustor to reduce NO_x formation, into the compressor to increase power production, and into the CTG inlet for evaporative cooling. The hot combustion gases will expand through the turbine section of the CTG, causing it to rotate and drive the electric generator and CTG compressors.

2.2.4 Combustion Turbine Generator

Two GE LM6000 PC Sprint CTGs have been selected for the HPP. Thermal energy will be produced in the CTGs through the combustion of natural gas, which will be converted into the mechanical energy required to drive the combustion turbine compressor and electric generator.

The CTGs will be equipped with the following accessories to provide safe, efficient, and reliable operation.

- Evaporative inlet air coolers

- Inlet air filters with silencers
- Turbine/generator control system
- Lube oil cooling system
- Compressor wash system
- Fire detection and protection system
- Generator cooling system
- Hydraulic starting system
- Acoustical enclosures

2.2.4.1 Air Pollution Control Systems

Each CTG will be equipped with an SCR emission control system that uses aqueous ammonia in the presence of a catalyst to reduce the NO_x concentration in the exhaust gases. The catalyst module will be located in a control system casing installed at the discharge of each CTG. Aqueous ammonia will be injected into the exhaust gas stream through a grid of nozzles located upstream of the catalyst module. The subsequent chemical reaction will reduce NO_x to nitrogen and water, resulting in a NO_x concentration of 3.6 or less ppmvd at 15 percent oxygen in the exhaust gas. An oxidation catalyst will reduce CO concentrations to 6 or less ppmvd at 15 percent oxygen and VOC emissions to 2 or less ppmvd at 15 percent oxygen.

2.2.4.2 Emergency Diesel Engine

A 250-kilowatt (kW) emergency diesel generator (397 horsepower) will be installed for backup facility power and as an emergency driver for the firewater pump. The engine will normally be operated for approximately 15 minutes once each week to establish reliability.

2.2.5 Major Electrical Equipment and Systems

All power exported from the HPP will be delivered to the PG&E electrical transmission/distribution grid. The plant will generate its own auxiliary loads, including pumps, fans, control systems, and general facility loads such as lighting, heating, and air conditioning.

Some power will also be converted from alternating current (AC) to direct current (DC) for use as backup power for control systems and other uses. The following sections describe the transmission system and the HPP plant internal electrical systems.

2.2.5.1 AC Power – Transmission

Power will be generated by the CTG at 13.8 kV. An overall single-line diagram of the facility's electrical system is shown on Figure 2-2. The two 13.8-kV generator outputs will be connected to individual oil-filled generator step-up transformers, which will increase the voltage to 70 kV. Surge arresters will be provided at the high-voltage bushings to protect the transformers from surges on the 70-kV system caused by lightning strikes or other system disturbances. The transformers will be set on concrete pads within containment areas designed to contain the transformer oil in the event of a leak or spill. The high-voltage side of each step-up transformer will be connected to the plant's 70-kV switchyard. From the switchyard, power will be transmitted through a new overhead transmission line to the Henrietta Substation, which is contiguous with the northern boundary of the HPP.

2.2.5.2 AC Power – Distribution to Auxiliaries

Auxiliary power to the HPP plant will be supplied at 4,160 volts and at 480 volts AC. Power to the 4,160-volt AC system will be supplied by one oil-filled 13.8-kV to 4,160-volt transformer. Power to the 480-volt system will be supplied from a 4,160-volt to 480-volt oil-filled transformer. When power is not available through the 70-kV interconnection to the PG&E grid, the diesel generator will provide emergency load requirements for the HPP.

The 4,160-volt system will supply power to the 4,160-volt motor control center (MCC). Loads on this system include the natural gas fuel compressors and the transformer rated 4,160 to 480 volts for 480-volt power distribution. The switchgear will have vacuum breakers for the main incoming feeds and fused contactors for power distribution.

The 480-volt MCCs will provide power through feeder breakers to the various 480-volt motors, to 480-volt power panels, and to other intermediate 480-volt loads. The MCCs will distribute power to 480-480/277-volt isolation transformers when 277-volt, single-phase lighting loads are to be served. The 480-volt power panels will distribute power to small 480-volt loads.

The 480-volt MCC and power panels will provide power to the 120/208-volt AC supply system. The 480-120/208-volt system will use dry-type transformers.

2.2.5.3 DC Power Supply

One common DC power supply system consisting of 125-volt DC batteries, a 125-volt DC full-capacity battery charger, metering, ground detectors, and distribution panels will be supplied for the balance-of-the-plant and CTG equipment.

Under normal operating conditions, the battery chargers will supply DC power to the DC loads. The battery chargers will receive 480-volt, three-phase AC power from the AC power supply (480-volt) system and continuously charge the batteries while supplying power to the DC loads. The ground detection scheme will detect grounds on the DC power supply system.

Under abnormal or emergency conditions, when power from the AC power supply (480-volt) system is unavailable, the batteries will supply DC power to the system loads. The diesel generator will provide 480-volt power to the chargers under emergency conditions.

The 125-volt DC system will also be used to provide control power to the 4,160-volt switchgear, the 480-volt switchgear, critical control circuits, protective relays, and the emergency DC motors.

2.2.5.4 Essential Service AC Uninterruptable Power Supply

The CTG power block will also have an essential service 120-volt AC, single-phase, 60-hertz (Hz) power source. This source will supply AC power to essential instrumentation, critical equipment loads, and unit protection and safety systems that require uninterruptable AC power. The essential service AC system and DC power supply system will be designed to ensure that critical safety and unit protection control circuits have power and can take the correct action on a unit trip or loss of plant AC power.

The essential service AC system will consist of one full-capacity inverter, a solid-state transfer switch, a manual bypass switch, an alternate source transformer and voltage regulator, and an AC panelboard.

The normal source of power to the system will be the DC power supply system through the inverter to the panelboard. A solid-state static transfer switch will monitor the inverter output and the alternate AC source continuously. The transfer switch will automatically transfer essential AC loads without interruption from the inverter output to the alternate source upon loss of the inverter output.

A manual bypass switch will also be included to enable isolation of the inverter-static transfer switch for testing and maintenance without interruption to the essential service AC loads.

2.2.6 Fuel System

The CTGs will be designed to burn natural gas. Maximum natural gas required for base load operation of the plant is approximately 20,400 million British thermal units (Btu) per day on a lower heating value (LHV) basis.

The pressure of natural gas delivered to the site via pipeline (see Section 7.0, Natural Gas Supply) is expected be within the range of 290 to 400 pounds per square inch gauge (psig). The natural gas will be pressurized by onsite compressors, as needed, and then flow through gas scrubber/filtering equipment, a gas pressure control station, a fuel gas heater, and a flow metering station before entering the CTG.

2.2.7 Water Supply and Use

This section describes the quantity of water required, the source of the water supply, water quality, and water treatment requirements. A water balance diagram for operation at 63 °F ambient air temperature and 60 percent relative humidity, and at 98 °F ambient air temperature and 36 percent relative humidity, showing the various water requirements and estimated flow rates for the facility at annual average and peak daily conditions, is presented on Figures 8.14-1 and 8.14-2.

2.2.7.1 Water Requirements

Table 2-1 shows a breakdown of the estimated average daily quantity of water required for the HPP. Table 2-2 shows the estimated peak daily water requirements for the HPP. Estimated quantities are based on a simple-cycle plant operating 24 hours per day.

2.2.7.2 Water Supply

The HPP will require approximately 150 acre-feet of water per year. All of the facility water for the HPP will be provided by the Westlands Water District and Kings County. Will-serve letters are provided in Appendix G.

Bottled water for drinking will be delivered to the site periodically by truck.

2.2.7.3 Water Quality

An analysis of the water sources is provided in Section 8.14 (Water Resources).

2.2.7.4 Water Treatment

The HPP will include a water treatment system for treating the water supply, which will provide higher quality water suitable for use in the combustion turbine evaporative coolers and water injection system. Water treatment will be performed through the use of a microfiltration system, a multistage reverse osmosis (RO) system, and an electro-deionization system. Demineralized water will be stored in an onsite tank. In addition, demineralized water will be used for CTG compressor washing. This water processing system will minimize the use of makeup water in the plant. Untreated supply water will be used for other purposes, such as in the service and fire water systems.

2.2.8 Plant Cooling Systems

Since the project is a simple-cycle power plant, no cooling system (such as a cooling tower) is required. The CTG and gas compressors will use an air-cooled heat exchanger for the lubrication oil cooling system. Evaporative cooling would consist of treated water that is injected into the air intake structure on the CTG using “foggers.” The use of this evaporative cooling technology results in a zero-discharge, as all of the water is evaporated and passed through the CTG.

2.2.9 Waste Management

Waste management is the process whereby all wastes produced at the HPP will be properly collected, managed, treated off site, if necessary, and disposed of off site. Wastes include wastewater, solid nonhazardous waste, and hazardous waste (liquid and solid). Waste management is discussed in more detail in Section 8.13 (Waste Management).

2.2.9.1 Wastewater Collection, Treatment, and Disposal

The water-balance diagrams for the HPP are presented on Figures 8.14-1 and 8.14-2. The expected flow rates of the wastewater streams for both average daily ambient temperature (63 °F) and peak daily ambient temperature (98 °F) are provided in Tables 2-1 and 2-2, respectively. As illustrated, the primary wastewater discharge for the plant is from the water RO treatment and demineralization systems. This wastewater stream will be collected in a storage tank and then processed through the use of a mechanical vapor recompression unit to concentrate dissolved solids in the wastewater stream and to recycle water for use in the facility, resulting in a reduction in water supply for the HPP. The recycled clean water will be returned to the raw water holding tank and the small amount of concentrated slurry discharge will be stored in a wastewater tank and periodically transported off site for disposal. Waste streams from the oil-water separator and turbine wash-water will be collected in separate holding tanks and will also be periodically transported off site for disposal.

2.2.9.2 Stormwater Management

Contact stormwater runoff (from equipment areas on the site) associated with the operation and maintenance phase will be controlled and contained within the HPP site. This runoff will be confined within the site and be routed to an oil-water separator. The water from the oil-water separator will be used for makeup water. The recovered oil will be kept in a separate tank and disposed of offsite periodically. The area inside the fence line will be bermed and graded to direct noncontact stormwater runoff to a drainage system that discharges to the onsite evaporation/percolation pond. The drainage system for the HPP site has been designed to manage the stormwater runoff resulting from a maximum 10-year, 10-day rainfall event to prevent flooding of permanent facilities and roads.

2.2.9.3 Solid Waste

The HPP will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other miscellaneous solid wastes, such as the typical refuse generated by workers. These waste materials will be collected by a waste collection company and transported to a material recovery facility. Recyclables will be removed and the remaining residues deposited in a landfill, such as the Kings County Landfill (see Section 8.13). Waste collection and disposal will be performed in accordance with applicable regulatory requirements to minimize health and safety effects.

2.2.9.4 Hazardous Wastes

Several methods will be used to properly manage and dispose of hazardous wastes generated by the HPP. Waste lubricating oil will be recovered and recycled by a licensed recycling contractor. Spent lubrication oil filters will be disposed of in a Class I landfill off site. Workers will be trained to properly handle hazardous waste generated at the site. Periodically, the SCR and oxidation catalysts must be replaced and will be recycled off site by the catalyst supplier.

2.2.10 Management of Hazardous Materials

Various chemicals will be stored and used during the construction and operation of the HPP. All chemicals will be stored, handled, and used in accordance with applicable laws, ordinances, regulations, and standards (LORS). Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, or in returnable delivery containers. Chemical storage and chemical use areas will be designed to contain leaks and spills. Berm and drain piping design will allow a full-tank-capacity spill without overflowing the berms. For multiple tanks located within the same bermed area, the capacity of the largest single tank will determine the volume of the bermed area and drain piping. Drains from the chemical storage and use areas will be isolated to control the release of liquids. Routine inspections of all chemical storage areas will occur on a daily basis by plant personnel when the plant is in operation. The drain valves will normally be closed to prevent a release from the containment area. Should a chemical spill occur, the liquid will be contained and appropriate cleanup measures taken. Accumulated stormwater in the containments areas will be tested prior to manual release to the stormwater collection basin.

Aqueous ammonia will be stored in an aboveground, double-walled storage tank. The truck unloading station and ammonia pump station will be connected to an underground containment structure to collect aqueous ammonia should a spill or leak occur.

Safety showers and eyewashes will be provided adjacent to, or in the area of, all chemical storage and use areas. Water hose connections will be provided near the chemical storage and feed areas to flush spills and leaks. Plant personnel will use state-approved personal protective equipment during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material will be stored on site for spill cleanup. Electric equipment insulating materials will be specified to be free of polychlorinated biphenyls (PCBs).

A list of the chemicals anticipated for use at the power plant is provided in Table 8.12-1 for the construction phase and Table 8.12-2 for the operation and maintenance phase. These tables identify each chemical by type and intended use and estimate the quantity to be stored on site. Section 8.12 includes additional information on hazardous materials handling.

2.2.11 Emission Control and Monitoring

Air emissions from the combustion of natural gas in the CTG will be controlled using state-of-the-art systems. Emissions that will be controlled include NO_x, VOCs, and CO. To ensure that the systems perform correctly, continuous emissions monitoring (CEM) will be performed. Section 8.1 (Air Quality) includes additional information on emission control and monitoring.

2.2.11.1 NO_x Emission Control

SCR will be used to control NO_x concentrations in the exhaust gas emitted to the atmosphere to 3.6 or less ppmvd at 15 percent oxygen. The SCR process will use aqueous ammonia. Ammonia slip, or the concentration of unreacted ammonia in the exiting exhaust gas, will be limited to 10 or less ppmvd at 15 percent oxygen. The SCR equipment will include a reactor chamber, catalyst modules, aqueous ammonia storage system, ammonia vaporization and injection system, and monitoring equipment and sensors.

2.2.11.2 CO and VOC Emission Control

CO and VOCs will be controlled at the CTG combustor and by an oxidation catalyst that is part of the air pollution control system. CO will be controlled to 6 ppmvd or less at 15 percent oxygen, and VOCs will be controlled to 2 ppmvd or less at 15 percent oxygen.

2.2.11.3 Particulate Emission Control

Particulate emissions will be controlled by using natural gas as the sole fuel for the CTG. In addition, the CTGs will employ high-efficiency inlet air filtration.

2.2.11.4 Continuous Emission Monitoring

CEM systems will sample, analyze, and record fuel gas flow rate, exhaust gas flow rate, NO_x and CO concentration levels, and percentage of oxygen in the stack exhaust gas. This system will generate emission data reports in accordance with permit requirements and will send alarm signals to the plant control room when emission levels approach or exceed preselected limits.

2.2.12 Fire Protection

The fire protection system will be designed to protect personnel and limit property loss and plant downtime in the event of a fire. The fire protection system will include a dedicated underground fire loop piping system. The fire hydrants and the fixed suppression systems will be supplied from the fire water loop. An emergency diesel generator will provide a backup power supply for the fire water pump. Fixed fire suppression systems will be installed at determined fire risk areas, such as the administration/maintenance building. The CTGs will be protected by a carbon dioxide (CO_2) fire protection system. Hand-held fire extinguishers of the appropriate size and rating will be located throughout the facility in accordance with National Fire Protection Association Standard 10.

Section 8.12 (Hazardous Materials Handling) includes additional information on fire and explosion risk, and Section 8.8 (Socioeconomics) provides information on county fire protection capability.

2.2.13 Plant Auxiliaries

The following systems will support, protect, and control the generating facility.

2.2.13.1 Lighting

The lighting system will provide personnel with illumination for operation under normal conditions and for egress under emergency conditions. The system will include emergency lighting to perform manual operations during an outage of the normal power source. The system will also be provided with 120-volt convenience outlets for portable lamps and tools. Light will be directed toward the interior of the plant to minimize offsite light and glare impact. Lighting fixtures will also include shields and hoods to produce downcast.

2.2.13.2 Grounding

The electrical system will be susceptible to ground faults, lightning, and switching surges that can result in high voltage, constituting a hazard to site personnel and electrical equipment. The station grounding system will provide an adequate path to permit the dissipation of current created by these events.

The grounding grid will be designed for a capacity adequate to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentration. The grid spacing will be adequate to maintain safe voltage gradients.

Bare conductors will be installed below grade in a grid pattern. Each junction of the grid will be bonded together by an exothermal welding process or mechanical clamps.

Ground resistivity readings will be used to determine the necessary number of ground rods and grid spacings to ensure safe step-and-touch potentials under severe fault conditions. Grounding stingers will be brought from the ground grid to connect to building steel and nonenergized metallic parts of electrical equipment.

2.2.13.3 Control and Information System

The Control and Information System (CIS) will provide modulating control, digital control, monitoring, and indicating functions for the plant power block systems. The system will be capable of the following functions:

- Controlling the CTGs and other systems in a coordinated manner
- Controlling the balance-of-plant systems in response to plant demands
- Monitoring controlled plant equipment and process parameters and delivering this information to plant operators
- Providing control displays (printed logs, cathode ray tube [CRT]) for signals generated within the system or received from input/output (I/O)
- Providing consolidated plant process status information through displays presented in a timely and meaningful way
- Providing alarms for out-of-limit parameters or parameter trends, displaying on alarm CRT(s), and recording on an alarm log printer
- Storing and retrieving historical data

The CIS will be a redundant microprocessor-based system consisting of the following major components:

- CRT-based operator consoles
- Engineer workstation
- Distributed processing units
- I/O cabinets
- Historical data unit
- Printers

- Data links to the combustion turbine control systems

The CIS will interface with the control systems furnished by the combustion turbine supplier to provide remote control capabilities, as well as data acquisition, annunciation, and historical storage of turbine and generator operating information. The system will be designed with sufficient redundancy to preclude a single device failure from significantly affecting overall plant control and operation. Critical control and safety systems will have redundant subsystems and an uninterruptable power source.

2.2.13.4 Cathodic Protection

The cathodic protection system will be designed to control the electrochemical corrosion of designated metal piping buried in the soil. Depending upon the corrosion potential and the site soils, either passive or impressed current cathodic protection will be provided.

2.2.13.5 Freeze Protection

The freeze protection system will provide heat to various outdoor pipes, gauges, pressure switches, and other devices to protect them from freezing temperatures. The power supply for the freeze protection circuits will be controlled by an ambient temperature thermostat.

2.2.13.6 Service Air

The service air system will supply compressed air to hose connections for general plant use. Service air headers will be routed to hose connections located at various points throughout the facility.

2.2.13.7 Instrument Air

The instrument air system will provide dry air to pneumatic operators and devices. An instrument air header will be routed to locations within the facility equipment and water treatment areas where pneumatic operators and devices will be located.

2.2.14 Interconnect to Electrical Grid

The CTGs will be connected to individual, dedicated, three-phase step-up transformers, which will be connected to the plant's 70-kV switchyard. The switchyard will consist of an airbreak disconnect switch and SF6 circuit breakers. From the switchyard, the generated power will be transmitted along overhead lines into the PG&E substation adjacent to the facility. See Section 6.0 (Electric Transmission) for additional information on the switchyard, transmission line, and connection at the PG&E Henrietta Substation.

2.2.15 Project Construction

Construction of the generating facility, from site preparation and grading to commercial operation, is expected to take place from January 2002 to May 2002, for a total duration of five months of actual construction. Major milestones are listed in Table 2-3.

Access to the HPP site will be from 25th Avenue. The onsite construction laydown area and a construction parking area are shown on Figure 2-3a. It is anticipated that materials and equipment will be delivered to the site by truck.

The average and peak workforce on the project during construction will be approximately 75 and 93, respectively, including construction craft persons and supervisory, support, and construction management personnel (see Section 8.8, Socioeconomics).

Construction will be scheduled between 6 a.m. and 6 p.m., Monday through Saturday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. During the startup phase of the project, some activities will continue 24 hours a day, seven days a week. The construction period is scheduled to be 5 months in length. The peak construction workforce is expected to last from month 3 through month 4 of the construction period, with month 4 being the peak month.

2.2.16 Site Grading

The HPP site will be constructed using a balanced cut-and-fill approach. The site is relatively flat and the primary excavation is associated with the onsite stormwater pond.

Approximately 11,500 cubic yards of cut and 11,500 cubic yards of fill are anticipated to achieve the final balanced site grading. A site grading and drainage plan drawing is included in Appendix H1-2.

2.2.17 Power Plant Operation

The HPP will be operated by GWF personnel from existing operating facilities. Operators and maintenance staff will be dispatched from the Hanford Cogeneration plant to the facility as needed to operate the HPP.

GWF has executed a contract with the California Department of Water Resources (DWR) that provides for 4,000 hours per year of dispatch. During the first years of operation DWR, as determined by system demand requirements, may dispatch the HPP more than 4,000 hours per year. For this reason, GWF is seeking a license to operate the plant up to 8,000 hours per year.

Security of the facilities will be maintained on a 24-hour basis. In the unlikely event that a temporary cessation of operations is required, a contingency plan will be implemented in conformance with applicable LORS for the protection of public health, safety, and the environment. Depending on the expected duration of the shutdown, the plan may include the removal of chemicals from storage tanks and other equipment and the safe shutdown of all equipment. All wastes will be disposed of according to applicable LORS. If the cessation of operations becomes permanent, decommissioning will be undertaken (see Section 4.0, Facility Closure).

2.3 Facility Safety Design

The HPP will be designed to maximize safe operation. Hazards that could affect the facility include earthquake, flood, and fire. Facility operators will be trained in safe operation, maintenance, and emergency response procedures to minimize the risk of personal injury and damage to the plant.

2.3.1 Natural Hazards

The principal natural hazards associated with the HPP site are earthquakes, floods, and lightning strikes. The site is located in Seismic Risk Zone 3. Structures will be designed to meet the seismic requirements of California Code of Regulations Title 24 and the 1998 California Building Code (CBC). Section 8.15 (Geologic Resources and Hazards) discusses the geological hazards of the site and vicinity. This section discusses potential geologic hazards, seismic ground motions, and the potential for soil liquefaction due to ground shaking. Appendix H includes the structural seismic design criteria for the buildings and equipment.

The site is essentially flat, with an average elevation of approximately 225 feet above mean sea level (MSL). According to the Federal Emergency Management Agency (FEMA), the site is not within either the 100- or 500-year floodplain. Section 8.14 (Water Resources) provides additional information on the potential for flooding.

2.3.2 Emergency Systems and Safety Precautions

This section discusses the fire protection systems, emergency medical services, and safety precautions to be used by project personnel. Section 8.8 (Socioeconomics) includes additional information on area medical services, and Section 8.7 (Worker Health and Safety) includes additional information on safety for workers. Appendix H contains the design practices and codes applicable to safety design for the project. Compliance with these requirements will minimize project effects on public and employee safety.

2.3.2.1 Fire Protection Systems

The project will rely on both onsite fire protection systems and local fire protection services.

Onsite Fire Protection Systems. The fire protection systems will be designed to protect personnel and limit property loss and plant downtime from fire or explosion. The project will have the following fire protection systems.

CO_2 Fire Protection System. This system will protect the gas turbine, generator, and accessory equipment compartments from fire. The system will have fire detection sensors in all compartments. Actuating one sensor will provide a high temperature alarm on the combustion turbine control panel. Actuating a second sensor will trip the combustion turbine, turn off ventilation, close ventilation openings, and automatically release the CO_2. The CO_2 will be discharged at a design concentration adequate to extinguish the fire.

Fire Hydrants/Hose Stations/Building Sprinklers/Deluge System. These systems will provide fire protection for the exterior plant area, generator transformers, auxiliary transformers, administration building, and maintenance building. The main fire pump will be electrically driven and will deliver water to the hydrants, hose stations, and building sprinklers through an underground piping system from the raw water tank. The main fire pump will be powered from the 480-volt plant distribution bus and will be backed up by an emergency diesel generator. An electrically driven jockey pump will operate automatically to maintain water pressure in the fire system piping.

Fire Extinguisher. The plant administrative and maintenance buildings will be equipped with portable fire extinguishers as required by the local fire department.

Local Fire Protection Services. In the event of a major fire, plant personnel could call upon the Kings County Fire Department (KCFD) for assistance. The closest fire station is KCFD Station 7, located at the intersection of 18th Avenue and Indiana, approximately 10 miles from the HPP site (see Section 8.8, Socioeconomics). The Hazardous Materials Management Plan (see Section 8.12, Hazardous Materials Handling) for the plant will include all information necessary to permit fire fighting and other emergency response agencies to plan and implement safe responses to fires, spills, and other emergencies.

2.3.2.2 Personnel Safety Program

The HPP will operate in compliance with federal and state occupational safety and health program requirements. Compliance with these programs will minimize project effects on employee safety. These programs are described in Section 8.7 (Worker Health and Safety).

2.4 Facility Reliability

This section discusses the expected plant availability, equipment redundancy, fuel availability, water availability, and project quality control measures.

2.4.1 Plant Availability

Because of the HPP's predicted high efficiency, it is anticipated that the facility will normally be called upon to operate at high average annual capacity factors. The facility will be designed to operate at base load. Neither CTG is designed to operate at partial load, except during startup and shutdown. The HPP will be designed for an operating life of 30 years. The project will employ fully mature technology that has been commercially demonstrated for many years. Therefore, the plant maturation period for the HPP will be the period between start-up and commercial operation (approximately one month). Reliability and availability projections are based on this operating life, although the HPP could operate for a longer period. Operation and maintenance (O&M) procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

2.4.2 Redundancy of Critical Components

The following sections identify equipment redundancy as it applies to project availability. Specifically, redundancy in the balance-of-plant systems that serve the power block are described. Equipment redundancy is summarized in Table 2-4 and described in detail in Appendix H. Redundancy following final design may differ.

2.4.2.1 Power Block

The combustion turbine power generation train will be powered by two natural-gas-fired combustion turbines. The combustion turbine will provide 100 percent of the total simple-cycle power block output. The simple-cycle power block comprises the major components described below.

CTG Subsystems. The combustion turbine subsystems will include the combustion turbine, inlet air filtration and evaporative cooling system, generator and excitation systems, and turbine control and instrumentation. The combustion turbine will produce thermal energy through the combustion of natural gas; the thermal energy will be converted into mechanical energy through rotation of the combustion turbine, which drives the compressor and generator. Power output can be increased through steam injection upstream of the turbine section of the CTG. Each CTG generator will be totally enclosed and air-cooled. The generator excitation system will be a solid-state static system. Combustion turbine control and instrumentation (interfaced with the CIS) will cover the turbine generating system, the protective system, and sequence logic.

2.4.2.2 CIS

The gas-turbine control system as provided by the CTG system manufacturer is a triple-modular-redundant, microprocessor-based control system. A key feature is its three separate but identical controllers. All critical control algorithms, protective functions, and sequencing are performed by these processors, which provide the data needed to generate outputs to the turbine. Protective outputs are routed through the protective module, which consists of triple-redundant processors that also provide independent protection for critical functions such as overspeed.

The three control processors acquire data from triple-redundant sensors as well as from dual or single sensors. All critical sensors for continuous controls, and for protection, are triple redundant. Other sensors are dual or single devices fanned out to all three control processors. The extremely high reliability achieved by the triple-modular-redundant control systems is due, in considerable measure, to the use of triple sensors for all critical parameters.

The control system has extensive built-in diagnostics and includes “power-up,” background, and manually initiated diagnostic routines capable of identifying both control panel, sensor, and output device faults. These faults are identified down to the board level for the panel, and to the circuit level for the sensor or actuator component. On-line replacement of boards is made possible by the triple-redundant design and is also available for those sensors where physical access and system isolation are feasible.

2.4.2.3 Demineralized Water System

Water treatment will be performed through the use of a microfiltration system, a multistage RO system, and an electro-deionization system. Demineralized water will be stored in a 300,000-gallon onsite storage tank.

2.4.2.4 Compressed Air System

The compressed air system comprises the instrument air and service air subsystems. The service air system supplies compressed air to the instrument air dryers and to hose connections for general plant use. The service air system will include two 100-percent-capacity air compressors, service air headers, and distribution piping with hose connections. The instrument air system supplies dry compressed air at the required pressure and capacity for all control air demands, including pneumatic controls, transmitters, instruments, and valve operators. The instrument air system will include two 100-percent-capacity air dryers with prefilters and after filters, an air receiver, instrument air headers, and distribution piping.

2.4.3 Fuel Availability

Fuel will be delivered by Southern California Gas Company's existing transmission system. Capacity in the local system is sufficient to supply the HPP. It is conceivable that the transmission line or the connecting line to the HPP could become temporarily inoperable, resulting in fuel unavailability at the HPP. Because the HPP has no backup supply of natural gas, it will be shut down until the outage is corrected and gas service restored.

2.4.4 Water Availability

The water supply system is considered reliable, and no backup system has been provided. The availability of water to meet the needs of the HPP is discussed in more detail in Section 8.14 (Water Resources). The will-serve letters are included in Appendix G. Water for drinking purposes will be delivered by a bottled-water supplier.

2.4.5 Project Quality Control

The objective of the HPP Quality Control Program is to ensure that appropriate quality measures are applied to all systems and components during design, procurement, manufacturing, construction, and operation. The goal of the Quality Control Program is to achieve the desired levels of safety, reliability, availability, operability, constructability, and maintainability for the generation of electricity.

Quality assurance for a system is obtained by applying appropriate controls to various activities. For example, the appropriate controls for design work are checking and review, and the appropriate controls for manufacturing and construction are inspection and testing. Appropriate controls will be applied to each project activity.

2.4.5.1 Project Stages

For quality assurance planning purposes, project activities have been divided into nine stages. As the project progresses, the design, procurement, fabrication, erection, and checkout of each power plant system will progress through the stages defined below:

Conceptual Design Criteria. Activities such as the definition of requirements and engineering analyses.

Detailed Design. Activities such as the preparation of calculations, drawings, and lists needed to describe, illustrate, or define systems, structures, or components.

Procurement Specification Preparation. Activities necessary to compile and document the contractual, technical, and quality provisions of procurement specifications for plant systems, components, or services.

Manufacturer Control and Surveillance. Activities necessary to ensure that manufacturers conform to the provisions of procurement specifications.

Manufacturer Data Review. Activities required to review manufacturers' drawings, data, instructions, procedures, plans, and other documents to ensure coordination of plant systems and components and conformance to procurement specifications.

Receipt Inspection. Inspection and review of products upon delivery to the construction site.

Construction/Installation. Inspection and review of storage, installation, and cleaning and initial testing of systems or components at the plant site.

System/Component Testing. Actual controlled operation of power plant components in a system to ensure that the performance of systems and components conforms to specified requirements.

Plant Operation. Actual operation of the power plant system.

2.4.5.2 Quality Control Records

The following quality control records will be maintained for review and reference:

- Project instructions manual
- Design calculations
- Project design manual
- Quality assurance audit reports
- Conformance to construction records drawings
- Procurement specifications (contract issue and change orders)
- Purchase orders and change orders
- Project correspondence

For procured component purchase orders, a list of qualified suppliers and subcontractors will be developed. Before contracts are awarded, the subcontractors' capabilities will be evaluated. The evaluation will include consideration of suppliers' and subcontractors' personnel, production capability, past performance, and quality assurance program.

During construction, field activities will be accomplished during the last four stages of the project: receipt inspection, construction/installation, system/component testing, and plant operation. The construction contractor will be contractually responsible for performing the work in accordance with the quality requirements specified by the contract.

The subcontractors' quality compliance will be surveyed through inspections, audits, and the administration of independent testing contracts.

To control quality, the HPP will implement a plant O&M program typical for a project of this size. A specific O&M program for this project will be defined and implemented during initial plant startup.

2.5 Facility Design Laws, Ordinances, Regulations, and Standards (LORS)

2.5.1 Overview

Table 2-5 provides an overview of facility design LORS. See Appendix H for a more detailed presentation. The HPP will be constructed in accordance with all applicable LORS. Table 2-5 indicates specific facility design LORS, which agencies enforce them, and where conformance with the individual LORS is discussed. Proposed conditions of certification are contained in Appendix K. These conditions are proposed to ensure compliance with applicable LORS and/or to reduce potentially significant impacts to less-than-significant levels.

2.5.2 Facility Design

The following fundamental engineering fields are analyzed and discussed, where indicated, for LORS compliance.

2.5.2.1 Civil and Structural Engineering

The design of structures and facilities will be based on the codes, specifications, industry standards, and regulations, and other reference documents in effect at the time of design. Applicable codes and industry standards with respect to the project's engineering design criteria, construction, and operation are summarized in Appendix H1, Foundation and Civil Engineering Design Criteria, and Appendix H2, Structure and Seismic Engineering Design Criteria.

2.5.2.2 Mechanical Engineering

The design of structures and facilities will be based on the codes, specifications, industry standards, and regulations, and other reference documents in effect at the time of design. Applicable codes and industry standards with respect to the project's engineering design criteria, construction, and operation are summarized in Appendix H3, Mechanical Engineering Design Criteria. Applicable sections of system control design criteria, as summarized in Appendix H4, Control Engineering Design Criteria, will also be considered.

2.5.2.3 Electrical Engineering

The design of structures and facilities will be based on the codes, specifications, industry standards, and regulations, and other reference documents in effect at the time of design. Applicable codes and industry standards with respect to the project's engineering design criteria, construction, and operation are summarized in Appendix H5, Electrical Engineering Design Criteria. Applicable sections of system control design criteria, as summarized in Appendix H4, Control Engineering Design Criteria, will also be considered.

2.5.3 Typical Codes and Standards for Construction and Design

The following are typical codes and standards for general plant construction and design; additional codes and standards may be used, depending on the final plant design and equipment selection.

Air Conditioning and Refrigeration Institute (ARI)

- ARI 430-1989--Central Station Air Handling Units

Air Movement and Control Association (AMCA)

- AMCA-210 - 1985--Laboratory Methods of Testing Fans for Rotating
- AMCA-500 - 1989--Test Methods for Louvers, Dampers and Shutters

American Petroleum Institute (API)

- API 599--Steel and Ductile Iron Plug Valves

- API 608--Metal Ball Valves - Flanged and Butt-Welding Ends
- API 609--Lug and Wafer-Type Butterfly Valves
- API 610--Centrifugal Pumps for Petroleum, Heavy-Duty Chemical and Gas Industry Services

American Society of Civil Engineers (ASCE)

- ASCE 7--Minimum Design Loads for Buildings and Other Structures

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

- Handbook: Fundamentals - 1997
- Handbook: HVAC Applications - 1995
- Handbook: HVAC Systems and Equipment - 1996
- Handbook: Refrigeration - 1998
- Standard: 15-1994--Safety Code for Mechanical Refrigeration
- Standard: 52-1976--Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter
- Standard: 62-1989--Ventilation for Acceptable Indoor Air Quality
- Standard: 90.1-1989--Energy Efficient Design of Buildings

American Welding Society (AWS)

- Welding procedures and qualifications for welders will follow the recommended practices and codes of the AWS
  - AWS D1.4--Structural Welding Code - Reinforcing Steel

American Water Works Association (AWWA)

- AWWA Cl10--Ductile Iron and Gray Iron Fittings, 3 inches through 48 inches for Water and Other Liquids
- AWWA ClII--Rubber-Gasket Joints for Ductile-Iron and Grey Iron Pressure Pipe and Fittings

- AWWA C301--Prestressed Concrete Pressure Pipe, Steel-Cylinder Type For Water and Other Liquids
- AWWA C304--Design of Prestressed Concrete Cylinder Pipe
- AWWA C502 Dry-Barrel Fire Hydrant
- AWWA C906--Polyethylene Pressure Pipe and Fittings, 4 inches through 63 inches for Water Distribution
- AWWA D100--Welded Steel Tanks for Water Storage
- AWWA Ml 1--Water Supply Practices, Pipe - Design and Installation

California Energy Commission

- Recommended Seismic Design Criteria for Non-Nuclear Generating Facilities in California

California Occupational Health and Safety Administration (OSHA and CAL-OSHA)

- Design and construction will conform to federal and California Occupational Safety and Health Administration (OSHA and CAL-OSHA) requirements

Chartered Institute of Building Services Engineers (CIBSE)

- Guide-A

Crane Technical Paper

- 410--Flow of Fluids Through Valves, Fittings, and Pipe

Concrete Reinforcing Steel Institute (CRSI)

- Manual of Standard Practice
- Structural concrete and reinforcing steel will be designed and placed in accordance with the codes, guides, and standards of the American Concrete Institute (ACI) and the CRSI.

Factory Mutual (FM)

- Roof covering design will comply with the requirements of the FM

Federal

- Title 29, Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards
- Title 29, CFR, Part 1926, National Safety and Health Regulations for Construction
- Walsh-Healy Public Contracts Act (Public Law 50-204.10)

General Electric Standards

- Station Designers Handbook
  - GEK 27060B--Design Recommendations for Steam Piping Systems Connected to Steam Turbine Generators

Heat Exchange Institute (HEI)

- Standard for Power Plant Heat Exchangers
- TEMA (Tubular Exchanger Manufacturers Association)

Hydraulic Institute (HI)

- Standards for Centrifugal, Rotary & Reciprocating Pumps

International Society for Measurement & Control

- ISA S7.3--Quality Standard for Instrument Air

Metal Building Manufactures Association (MBMA)

- Low-Rise Building Systems Manual

National Environmental Balancing Bureau (NEBB)

- Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems - 1992

National Fire Protection Association (NFPA)

- Roof covering design will comply with the requirements of the NFPA

- NFPA 10--Portable Fire Extinguishers
- NFPA 12--Carbon Dioxide Extinguishing Systems
- NFPA 13--Installation of Sprinkler Systems
- NFPA 14--Installation of Standpipe and Hose Systems
- NFPA 15--Water Spray Fixed Systems for Fire Protection
- NFPA 22--Standard for Water Tanks for Private Fire Protection
- NFPA 24--Private Fire Service Mains and Their Appurtenances
- NFPA 30--Flammable and Combustible Liquids Code
- NFPA 70--National Electric Code
- NFPA 72--Protective Signaling Systems
- NFPA 80 --Standard for Fire Doors and Fire Windows
- NFPA 85--Fire Protection for Electric Generating Plants
- NFPA 850--Recommended Practice for Fire Protection for Electric Generating Plants
- NFPA 90A--Installation of Air Conditioning and Ventilating Systems
- NFPA 90B--Installation of Warm Air Heating and Air Conditioning Systems

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

- HVAC Duct Construction Standards, Metal and Flexible, First Edition - 1985

State

- Business and Professions Code Section 6704, et seq.; Sections 6730 and 6736. Requires state registration to practice as a Civil Engineer or Structural Engineer in California.
- Labor Code Section 6500, et seq. Requires a permit for construction of trenches or excavations 5 feet or deeper into which personnel have to descend.

This also applies to construction or demolition of any building, structure, false work, or scaffolding that is more than three stories high or equivalent.

- Title 24, California Code of Regulations (CCR) Section 2-111, et seq.; Section 3-100, et seq.; Section 4-106, et seq.; Section 5-102, et seq.; Section 6-T8-769, et seq.; Section 6-T8-3233, et seq.; Section 6-T8-3270, et seq.; Section 6-T8-5138, et seq.; Section 6-T8-5465, et seq.; Section 6-T8-5531, et seq.; and Section 6-T8-5545, et seq. Adopts current edition of the California Building Code as minimum legal building standards.
- Title 8, CCR Section 1500, et seq.; Section 2300, et seq.; and Section 3200, et seq. Describes general construction safety orders, industrial safety orders, and work safety requirements and procedures.
- Regulations of the following state agencies, as applicable:
  - Department of Labor and Industry Regulations
  - Bureau of Fire Protection
  - Department of Public Health
  - Water and Power Resources

Steel Structures Painting Council (SSPC)

- Steel Structures Painting Manual, Volume 2, Systems and Specifications
- Metal surfaces for coating systems will be prepared following the specifications and standard practices of the SSPC and the specific instructions of the coatings manufacturer.

Underwriters Laboratory (UL)

- UL-555-1990--Fire Dampers
- UL-1025-1991--Electric Air Heaters
- UL-1042-1987--Electric Baseboard Heating Equipment
- UL-1046-1986--Electric Central Air Heating Equipment
- National Board Rules for Boiler Blow-off Tanks

Civil/Architectural

- Other recognized standards will be used where required to serve as guidelines for design, fabrication, and construction. When no other code or standard governs, the California Building Code, 1998 Edition as amended by the Los Angeles County Code, will govern.

International Conference of Building Officials

- California Building Code
- Seismic standards and criteria will follow the California Building Code
- Uniform Building Code, 1997 is mentioned but specifics of Chapter 708 are not. Chapter 708 includes the following:
  - 7006 (Grading Plans)
  - 7009 (Cuts)
  - 7012 (Terraces)
  - 7013 (Erosion Control)
  - 7015 (Final Report)
  - Figure 16-1 (Minimum Basic Wind Speeds)
  - Table 16-H, Method 1 (Wind Velocity Pressure Coefficients)
  - Figure 16-2 (Seismic Zone Map)
  - Appendix 15, Figure A-16-1 (Ground Snow Loads)
  - Section 1909 (Load Factors and Load Combinations Reinforced Concrete)
  - Section 1612 (Load Factors and Load Combinations Steel Structures)
- Standard Plumbing Code, 1997
- ASCE 7-95
- ACI 318-95/318R-95, Building Code Requirements for Structural Concrete and Commentary
- CRSI Manual of Standard Practice

- AISC Specification for Structural Steel Buildings, Allowable Stress and Plastic Design, 1989
- AWS Dl.1, American Welding Society Structural Welding Code for Steel
- ASTM, American Society for Testing and Materials Standards (as applicable)
- AASHTO-HS-20-44 (Truck Support Structures)
- Occupational Safety and Health Standard (OSHA)
- Walking and Working Surfaces, Subpart D
- Lighting
- ANSI/ASME STS-1-1992 (Steel Stacks)
- ASTM A 615, ASTM a 36, ASTM A 572, ASTM A 325, ASTM A 490, ASTM A 307, and ASTM A 185 (Steel Grades)
- ASTM C270, ASTM C129, and ASTM C 476 (Concrete Grades)
- NFPA 101, National Fire Protection Association, Life Safety Code
- NFPA 850, National Fire Protection Association, Recommended Practice of Fire Protection for Electric Generating Plants

Electrical

- Specifications for materials will follow the standard specifications of the American Society for Testing and Materials (ASTM), the Institute of Electrical and Electronics Engineers (IEEE), and the American National Standards Institute (ANSI), unless noted otherwise.

  ANSI C2-1993--National Electrical Safety Code

  ANSI C37.06-1987 (R1994)--Standard - AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis, Preferred Ratings and Related Required Capabilities

  ANSI C37.010-1979 (R1989)--Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

  ANSI C50.41-1982--Polyphase Induction Motors for Power Generating Stations

ANSI C57.12.51-1981 (R1989)--Requirements for Ventilated Dry-Type Power Transformers 501 kVA and Larger, Three-Phase with High-Voltage 601 to 34,500 Volts, Low Voltage 208Y/120 to 480 Volts

ANSI C57.19.00-1991--General Requirements and Test Procedure for Outdoor Power Apparatus Bushing

ANSI/IEEE 422-1986--Guide for the Design and Installation of Cable Systems in Power Generating Substations

ANSI/IEEE 525-1993--Design and Installation of Cable Systems in Substations

ANSI/IES RP7-1990--Practice for Industrial Lighting

ANSI/IEEE C37.13-1990--Low Voltage AC Power Circuit Breakers Used in Enclosures

ANSI/IEEE C37.20.1-1993--Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear

ANSI/IEEE C37.20.2-1994--Metal-Clad and Station-Type Cubicle Switchgear

ANSI/IEEE C37.21-1985 (R1992)--Control Switchboards

ANSI/IEEE C57.12.00-1993--General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

ANSI/IEEE C57.13-1978 (R1987)--Requirements for Instrument Transformers

ANSI/IEEE C57.1 15-1992--Guide for Loading Mineral-Oil Immersed Power Transformers Rated in Excess of 100 millivolt amperes (mVA)

ANSI/IEEE 80-1986 (R1991)--Safety in AC Substation Grounding

ANSI/IEEE 141-1993--Recommended Practice for Electric Power Distribution for Industrial Plants

ANSI/IEEE 142-1991--Grounding of Industrial and Commercial Power Systems

ANSI/IEEE 242-1986 (R1991)--Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

ANSI/IEEE 399-1990--Recommended Practice for Power Systems Analysis

IEEE 485-1983--Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations

ANSI/IEEE 1119-1988 (R1993)--Guide for Fence Safety Clearances in Electric-Supply Stations

NEMA MG1-1993--Motors and Generators

NEMA MG2-1989--Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

NEMA SG3-1990--Low-Voltage Power Circuit Breakers

NEMA SG4-1990--Alternating Current High-Voltage Circuit Breakers

ANSI/NEMA 250-1991--Enclosures for Electrical Equipment

ANSI/NFPA 70-1993--National Electrical Code

NEMA PE1-1992--Uninterruptable Power System

ASTM E 84--Insulation Flame Spread

NFPA/ANSI Cl, Article 500--Initiation Criteria

ANSI 2, Article 127--Generator Station Hazardous Area Criteria for Electrical Protection

NEC Article 500, Standard 497M--Classification of Hazardous Elements

NEC Articles 501 and SO2--Standards for Construction of Electrical Equipment in Hazardous Areas

ANSI/IES RP-7-1979--Industrial Lighting

ANSI/IES RP-8-1 979--Roadway Lighting

I&C Standards

- American Society of Mechanical Engineers (ASME):

PTC 19.3, Temperature Measurement

PTC 19.5, Flow Measurement

Fluid Meters, 6th Edition

B31.1, Power Piping

- American National Standards Institute (ANSI):

  ANSI/FCI 70-2, Control Valve Seat Leakage Classifications

  B 16.5, Pipe Flanges and Flanged Fillings

  B 16.34, Valves - Flanged and Butt-Welding End

- Electronic Industries Association (EIA):

  RS-232C, Interface Between Data Terminal Equipment and Data Communications Equipment

- Institute of Electrical and Electronics Engineers (IEEE):

  518, Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources

  142, ANSI/IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems

  802.4, Ethernet

  472, Surge Withstand Capability

  998, Lighting Protection Systems

- Instrument Society of America (ISA):

  MC 96.1, Temperature Measurement Thermocouples

  RP 3.2, Flange-Mounted, Sharp Edge Orifice Plates for Flow Measurements

  S5.1, Instrumentation Symbols and Identification

  S5.2, Binary Logic Diagrams for Process Operations

  S5.4, Instrument Loop Diagrams

  S5, Graphic Symbols for Process Displays

  S50.1, Compatibility of Electronic Signals For Industrial Process Instruments

  SSI.1, Process Instrumentation Terminology

  ANSI/ISA S75.01, Control Valve Sizing Equations

  ANSI/ISA S75.02, Control Valve Capacity Procedure

70, National Electric Code

- National Electrical Manufacturers Association (NEMA):

  4, Class Enclosure

  ICS 1, General Standards for Industrial Controls and Systems

  250, Enclosures for Electrical Equipment (1,000 Volts Maximum)

- Scientific Apparatus Makers Association (SAMA):

  PMC 20.1, Process Measurement and Control Terminology, PMC 22.1, Functional Diagramming of Instrument and Control Systems

Gas Turbine Generator Codes and Standards

- The following are codes and standards for gas turbine generators. This list is typical for gas turbine-generator design; additional codes and standards may be used, depending on the final plant design and equipment selection.

  ANSI/ASME 7-1995--Minimum Design Loads for Buildings and Other Structures

  ANSI/ASME Bi.1-1989--Unified Inch Screw Threads

  ANSI/ASME Bi.20.1-1983--General Purpose (Inch) Pipe Threads

  ANSI/ASME B16.21 -1992--Nonmetallic Flat Gaskets for Pipe Flanges

  ANSI/IEEE C37.90.1-1989--Surge Withstand Capability Tests for Protective Relays and Relay Systems

  ANSI/IEEE C37.101-1993--Guide for Generator Ground Protection as Applicable to High Impedance Grounding

  ANSI/IEEE C57-1995--Compilation of all C57 Transformer Standards

  ANSI C50.10-1990--Rotating Electrical Machinery - Synchronous Machines

  ANSI C50.13-1989--Rotating Electrical Machinery - Cylindrical Rotor Synchronous Generators

  ANSI C50.14-1977--Requirements for Combustion Gas Turbine-Driven Cylindrical Rotor Synchronous Generators

  ANSI/IEEE 100-1996--Dictionary of Electrical and Electronics Terms

  NEMA TRI-1993--Transformers, Regulators, and Reactors

NFPA 497A-1992--Classification of Class I Hazardous (Classified Locations for Electrical Installations in Chemical Process Areas)

NFPA 8506-1995--Standard on Heat Recovery Steam Generator Systems

ANSI S1.4-1983--Specification for Sound Level Meters

ANSI S1.13-1995--Methods for the Measurement of Sound Pressure Levels

ANSI/SAE/J 184-Feb. 1987--Qualifying a Sound Data Acquisition System

ANSI/ASME B31.3-1996--Chemical Plant and Petroleum Refinery Piping Gas Turbine Piping Systems

ANSI/ASME PTC-36-1985--Measurement of Industrial Sound

ANSI B133.2-1997--Basic Gas Turbine

ANSI B133.3-1981--Gas Turbine-Procurements Standard Auxiliary Equipment

ANSI B133.4-1978--Gas Turbine Control and Protection Systems

ANSI B133.5-1978--Gas Turbine Electrical Equipment

ANSI B133.8-1977--Gas Turbine Installation Sound Emissions

ANSI/IEEE C37-1995--Guides and Standards for Circuit Breakers, Switchgear, Substations, and Fuses

ANSI/IEEE C37.1-1994--Definition, Specification, and Analysis of Systems

ANSI/IEEE C37.2-1996--Electrical Power Systems Device Function Numbers

AGMA 6011-H97--Specifications for High-Speed Helical Gear Units

ANSI/IEEE 421.1-1996--Definitions for Excitation Systems for Synchronous Machines

EIAITIA RS-232E-1991--Interface Between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange

ANSI/ASME 846.1-1995--Surface Texture

ANSI Y14.SM-1994--Dimensioning and Tolerancing

ANSI Y14.15-1996--Electrical and Electronics Diagrams (On-Bas Gas Turbine and Accessory Bas Equipment)

ANSI Y14.17-1966--Fluid Power Diagrams

ANSI Y14.36-1978--Surface Texture Symbols

ANSI/IEEE 315-1975--Graphic Symbols for Electrical and Electronics Diagrams

ANSI Y32.10-1967--Graphic Symbols for Fluid Power Diagrams

ANSI Y32.11-1961--Graphic Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries

ANSI/ASME Y32.2.3-1949--Graphic Symbols for Pipe Fillings, Valves, and Piping

ANSI/AWS A2.4-1998--Symbols for Welding, Brazing, and Nondestructive Examination

ISO 7919-1-1986--Mechanical Vibrations - Measurements on Rotating Shafts and Evaluation

ISO 10816 (Draft)--Mechanical Vibrations - Evaluation of Machine Vibration by Measurements of Nonrotating Parts

TEMA C, 7th Edition--Mechanical Standards for Class C Heat Exchangers Crane Lifts; Factor of Safety

OSHA Regulations--Crane Lifts; Factor of Safety, No. 1910-179-1995

TABLES

Table 2-1
Estimated Average Daily Water Requirements (63 °F)

Water Use	Daily Requirements Gallons (per minute)
Water Injection (NO_x Control)	84
Water Injection (Power Augmentation)	11
Evaporative Cooling	6
Balance of Plant	1.7
Total	102.7

Table 2-2
Estimated Peak Daily Water Requirements (98 °F)

Water Use	Daily Requirements Gallons (per minute)
Water Injection (NO_x Control)	66
Water Injection (Power Augmentation)	22
Evaporative Cooling	16
Balance of Plant	1.7
Total	105.7

Table 2-3
Project Schedule Major Milestones

Activity	Date
Begin Construction	January 2002
Startup and Test	May 2002
Commercial Operation	June 2002

Table 2-4
Major Equipment Redundancy

Description	Number	Note
Simple-Cycle CTG	Two trains	No redundancy
Blowers for Air Dilution	One per train, 100 percent capacity	No redundancy
SCR and CO Catalyst	One module per train, 100 percent capacity	No redundancy
Compressed Air System	Two, 100 percent capacity	100 percent redundancy
Generator Breaker	Two trains	No redundancy
CT Auxiliary Load Supply Transformers	Two trains	100 percent redundancy
Cranking Motor Supply Transformers	Two trains	No redundancy
Unit Auxiliary Transformers	Two, 100 percent capacity	100 percent redundancy

Table 2-5
LORS Related to Facility Design

LORS	Applicability	AFC Conformance Section
	Need for Facility Demand Conformance	
		Section 2.5, Project Objectives
	Federal	
	None applicable	
	State	
	None applicable	
	Local	
	None applicable	
	Project Siting and Construction	
	Federal	
Uniform Building Code	Incorporated in and superseded by the CBC, 1998.	Section 2.3.1
	State	
Division of Industrial Safety	Boiler and Pressure Vessel Code Inspection.	Appendix H
	Local	
1997 Uniform Building Code containing the 1998 California Amendments; Title 24, Part 2, CCR		Appendix H
1997 Uniform Mechanical Code containing the 1998 California Amendments; Title 24, Part 4, CCR		Appendix H
1997 Uniform Plumbing Code containing the 1998 California Amendments; Title 24, Part 5, CCR		Appendix H
1996 National Electrical Code containing the 1998 California Amendments; Title 24, Part 3, CCR		Appendix H
CCR, Titles 19, 24, and 25	Applicable to work authorized by local jurisdiction via the permit process.	
1997 Uniform Fire Code	Applicable to work authorized by local jurisdiction via the permit process.	

Table 2-5 (continued)
LORS Related to Facility Design

LORS	Applicability	AFC Conformance Section
	Industry	
Foundation and Civil Engineering Design Criteria	Meet design criteria.	Appendix H
Structure and Seismic Engineering Design Criteria	Meet design criteria.	Appendix H
Mechanical Engineering Design Criteria	Meet design criteria.	Appendix H
Control Engineering Design Criteria	Meet design criteria.	Appendix H
Electrical Engineering Design Criteria	Meet design criteria.	Appendix H
	Project Design and Operation	
	Federal	
Occupational Health & Safety Act of 1970, 29 USC 651 et seq.; 29 CFR 1910 et seq.; and 29 CFR 1926 et seq.	Meet employee health and safety standards for employer-employee communications, electrical operations, and chemical exposures.	Section 2.3.2.2
Department of Labor, Safety and Health Regulations for Construction Promulgated Under Section 333 of the Contract Work Hours and Safety Standards Act, 40 USC 327 et seq.	Meet employee health and safety standards for construction activities. Requirements addressed by CCR Title 8, General Construction Safety Orders.	Section 2.3.2.2
Uniform Fire Code, Articles 80, 79, 4	Meet requirements for the storage and handling of hazardous materials, flammable and combustible liquids, and for obtaining permits.	Section 2.2.10
National Fire Protection Association (Refer to NFPA Table 7.4-1 for list of standards)	Meet standards necessary to establish a reasonable level of safety and property protection from the hazards created by fire and explosion.	Sections 2.2.12 and 2.3.2.1
14 CFR, Part 77, Objects Affecting Navigable Airspace	Completion of Notice of Proposed Construction or Alteration, FAA Form 7460-1H.	Section 6.2.2
Advisory Circular No. 70/7460, Obstruction Marking and Lighting	Meet FAA standards for marking and lighting of obstructions as identified by FAR Part 77.	Section 6.2.2
Advisory Circular 70/7460-2I, Proposed Construction or Alteration of Objects That May Affect the Navigable Airspace	Notify FAA prior to construction, as appropriate.	Section 6.2.2
14 CFR, Part 91, Air Traffic and General Operating and Flight Rules	Comply with restrictions governing the operation of aircraft, including helicopters.	Section 6.2.2

Table 2-5 (continued)
LORS Related to Facility Design

LORS	Applicability	AFC Conformance Section
49 USC § 1348, Subdivision (a)	Comply with Secretary of Transportation policy regarding safety of aircraft and utilization of airspace.	Section 6.2.2
47 CFR § 15.25, Operating Requirements, Incidental Radiation	Mitigation for any device that causes communications interference.	Section 2.2.5
Title 49 CFR, Part 192, Transportation of Natural and Other Gas by Pipeline	Construction must conform to Department of Transportation standards.	Section 6.2.4
	State	
CCR, Title 8	Meet requirements for a safe and hazard-free working environment. Categories of requirements include General Industry Safety Orders, General Construction Safety Orders, Electrical Safety Orders.	Section 2.3
California Clean Air Act, California Health & Safety Code, § 39650 et seq.	Meet requirements for Best Available Control Technology.	Section 8.1
California Health & Safety Code, Part 6, § 44300 et seq.	Estimate emissions for listed air toxic pollutants and submit inventory to air district for major sources of criteria air pollutants. Followup from air district may require a health risk assessment.	Section 8.12
20 CCR, Appendix B, Subdiv. (a), (d) (g) and Subdiv. (a), (h), §§ 1741–1744 and § 1752, Information Requirements for a Nongeothermal Application	Compliance with applicable laws for safety and reliability.	Each appropriate environmental section; for instance, Section 8.2 for Biological Resources
PRC, § 25000 et seq., Warren-Alquist Act, § 25520 Subdivision (g)	Provide description of transmission line including the right-of-way.	Section 2.14 and Section 6.0
General Order 52 (GO-52) CPUC, Construction and Operation of Power and Communication Lines	Prevent or mitigate inductive interference.	Section 2.2.5 and Appendices H1–H6
General Order 95 (GO-95) CPUC, Rules for Overhead Electric Line Construction	Design and construct line in compliance with GO-95.	Section 6.0 and Appendices H1–H6

Table 2-5 (continued)
LORS Related to Facility Design

LORS	Applicability	AFC Conformance Section
Radio & Television Interference (RI/TVI) Criteria	RI/TVI mitigation requirements if applicable.	Section 2.2.5 and Appendices H1–H6
	Local	
CCR, Titles 19, 24, and 25, and 1997 Uniform Fire Code, as amended by the State of California	Contain laws applicable to work authorized by local jurisdiction via the permit process.	
California Building Code, Seismic Zone 3		Section 8.15.2.2
	Industry	
EPRI, NERC, various codes and standards for components	EPRI and NERC trade associations guidelines will be followed.	Appendices H1–H6
Various	Industry codes and trade association standards are typically requirements of equipment manufacturers.	Appendices H1–H6
ANSI/AWWA C151/A21.5	Construction must conform to standards and related specifications.	Appendix H

Notes:
ANSI = American National Standards Institute
AWWA = American Water Works Association
CBC = California Building Code
CCR = California Code of Regulations
CEC = California Energy Commission
CFR = Code of Federal Regulations
EPRI = Electric Power Research Institute
FAA = Federal Aviation Administration
FAR = Federal Aviation Regulations
NERC = National Energy Regulatory Commission
OSHA = Occupational Safety and Health Administration
PRC = California Public Resources
UBC = Uniform Building Code
USC = United States Code

FIGURES